EXERCISE ARM ASSEMBLY FOR EXERCISE MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of Application Serial No. 10/417,431 filed April 16, 2003, which was a continuation of Application Serial No. 09/516,093 filed February 29, 2000, now U.S. Patent No. 6,579,213.

BACKGROUND OF THE INVENTION

[0002] The present invention relates generally to weight-lifting exercise machines, and is particularly concerned with exercise arms for such machines for use in performing upper body exercises.

[0003] Various upper body exercises are performed for exercising different upper body muscle groups, such as pectoral (pec) fly, rear deltoid, chest press, and mid row exercises.

[0004] Originally, these upper body exercises were performed using hand-held weights. For pec fly and rear deltoid exercises, independent weights known as dumbbell were held in each hand. Chest press and mid row exercises could be performed using either a barbell, where a single weight is controlled by both hands, or two separate dumbbell. In a pec fly exercise, the exerciser would lie on a bench facing upwards with a weight in each hand, arms extended out to the side, and palms facing up, with the elbows bent. The exerciser would then lift the weights to bring the dumbbell together over their body with a slight arcing or elliptical pattern to the movement. For a rear deltoid exercise, the exerciser would lie face down on a bench with a dumbbell in each hand, with their arms straight down, palms facing each other, and elbows slightly bent. Keeping the

arms in the same bent position, the exerciser would lift the weights until their arms were straight out to the side.

[0005] In order to perform a chest press using dumbbell, the exerciser would lie face up on a bench with a weight in each hand, arms to each side with elbows bent and hands close to the chest. The exerciser would then push the weights up, bringing the dumbbell together over their body in a slight arcing or elliptical movement. In a mid row exercise, the exerciser would bend over at the waist with a weight in each hand, arms hanging straight down, and hands together with the palms facing each other. Staying in the bent position, the user would then pull the weights up to chest level with a slight arcing or elliptical pattern to the movement.

[0006] Various exercise machines have been designed in order to duplicate one or more of the free weight, upper body exercises such as pec fly, rear deltoid, chest press, and mid row. Typically, these machines have pivoted arms linked to an exercise resistance. There are several problems in attempting to combine two or more of the upper body exercises with a single exercise arm assembly, due to the different motions which must be accommodated for each exercise.

[0007] The earliest pec fly machine had two independent exercise arms pivotally mounted on a frame above the user's head. The arms were generally L-shaped with a pivot shaft attached to the end of one leg of the L and a pad or roller attached to the other leg. The user sat on a seat mounted on the frame with their upper arms parallel to the floor and forearms bent 90 degrees at the elbow. With their forearms resting against the pads, the user rotated their arms forward until they came together. Since the exercise arms had only one pivot, they could only move in a concentric or circular pattern, and the arms were non-adjustable for different users. In order to perform a rear deltoid exercise on this

machine, a user would sit facing the rear of the machine, placing their elbows on the pads, and trying to rotate their arms rearwards. This was a cramped, uncomfortable position which did not allow a full range of motion, and was of marginal value from an exercise point of view.

[0008] In view of the limitations of the earliest pec fly machine in performing rear deltoid exercises, a separate rear deltoid machine was designed, which allowed users to fully extend their arms and perform a full range of exercise motion. This machine had a second pivot to pivotally mount a handle at the bottom of the second leg of the L-shaped arm. The handle was T-shaped, with the bottom of the T pivotally secured to the exercise arm and the grip portion of the handle comprising the top of the T and oriented vertically. This machine could also be used for pec fly exercises, and had the advantage that the user's hands were placed in a more natural position.

[0009] A combination pec fly/rear deltoid machine encounters difficulties due to the fact that the two exercise movements are different. In the rear deltoid exercise, the natural position for the arms is fairly straight with a slight bend or break at the elbows throughout the entire movement, which is circular or concentric. In a pec fly exercise, the natural movement is more elliptical, since the starting width of the exerciser's grip is closer to their body at the beginning of the exercise than at the end. In order to function properly for both exercises, the original combination machines had to have a T handle short enough to provide the necessary pre-stretch for a rear deltoid exercise. This handle was not quite long enough to provide the swing necessary for the proper elliptical arc on a pec fly exercise.

[0010] In later machines, the rotating handle was eliminated and replaced with a swing arm, which hinged at the elbow of the L-shaped exercise arm. The second pivot was perpendicular to the first pivot at the top of the exercise arm,

and at the same elevation as the first pivot. Pads or handles were mounted to the swing arms to engage the user's forearms or hands.

[0011] Various machines have also been designed for performing press type exercises. U.S. Patent No. 5,916,072 of Webber describes an exercise apparatus with an exercise arm assembly for performing chest press and mid row exercises. A pair of swing arms are pivoted at opposite sides of a U-shaped, pivoted yoke. Various alternative configurations are described, including some in which the swing arms have two pivoting sections. All the designs have parallel pivots and cannot provide a converging, pulling exercise movement. This design will not work for a combination machine with pushing/pulling converging movement.

[0012] U.S. Patent No. 5,181,896 of Jones describes an exercise machine for performing incline press exercises which has independent, fixed arc, converging exercise arms. This can be used for only one type of exercise. U.S. Patent No. 5,643,252 of Simonson describes independent, single piece exercise arms that travel in a fixed arc and can be used for performing chest press exercises. The handles are rigidly secured to the exercise arms.

[0013] None of the prior art exercise machines for performing upper body exercises have exercise arms which can readily duplicate the motions required for both pushing and pulling exercises, and which can adjust readily for user's arm length and desired starting pre-stretch. Additionally, the handles provided in prior art machines often have limited or no ability to adjust to the most natural hand/wrist position throughout the entire exercise movement. A number of prior art machines allow only one, fixed hand position during the entire exercise, and allow little or no adjustment of the arc of the exercise movement.

SUMMARY OF THE INVENTION

[0014] It is an object of the present invention to provide a new and improved exercise arm assembly for an exercise machine which can be used for either pushing or pulling exercises, or used on a combination machine for performing both types of exercise.

[0015] According to the present invention, an exercise arm apparatus is provided which comprises a pair of exercise arm assemblies, each arm assembly having a main arm having a first end for pivoting on a frame of an exercise machine for pivoting about a first pivot axis, a swing arm having a first end pivoted to the main arm for pivoting about a second pivot axis, and a handle pivoted to the swing arm for pivoting about a third pivot axis, each pivot axis being non-parallel to the other two pivot axes, at least two of the pivot axes also being non-perpendicular to one another.

[0016] In prior art exercise arm assemblies with multiple pivots, there were always at least two pivot axes extending parallel to one another. In the present assembly, the tri-pivot system, each pivot axis is non-parallel to both of the other pivot axes, and at least two pivot axes are not perpendicular. This provides a multi-dimensional exercise arm which can perform both concentric and eccentric exercise movements. The first pivot axis may be vertical or horizontal while the other two may extend at acute or obtuse angles to the first pivot axis. Because of this, the handles can be positioned so that they are on the inboard side of the swing arms, facing the user, at all times. This allows the handles to be completely adjustable and self-aligning during either a pec fly or rear deltoid exercise, and provides the user with an unlimited number of hand positions.

[0017] Preferably, the main arm has a downwardly angled bend, so that the swing arm hinges to the main arm below the level at which the main arm

pivots to the frame. The swing arm preferably also has an angled bend, so that it angles outwardly from its pivotal connection to the main arm, and then downwardly to the handle. This allows the second pivot axis to be brought in closer to the exerciser, while still allowing the swing arm and handles to swing out wide enough to perform the various exercises correctly. The swing arms are free swinging and are not affected by the resistance, nor do they affect the resistance.

[0018] The rotation of the swing arm about the second pivot axis may be limited by a range limiting system, comprising a pin connected to one of the arms and a pair of spaced end stops on the other arm to engage the pin as the swing arm is rotated in opposite directions about the second pivot axis. The end stops may be arranged to define a first, inner end position of the swing arm in which it is positioned in a generally vertical orientation and a second, outer end position of the arm in which it is angled outwardly. The second end position is designed to restrict the outward movement of the swing arm so as to prevent contact with the machine frame.

[0019] The handle may have a pivoting grip mounted perpendicular to the third, or handle, pivot axis. The grip pivots freely about its axis and allows the user to adjust their hand/wrist position at any time during the course of an exercise without causing strain or binding to the wrist.

[0021] The combination of pivoting grip, handle and swing arm allows the user to determine their ideal exercise path, and provides self-alignment during the course of the exercise movement. As the swing arms are raised, the handles will automatically adjust to keep the user's hands in the most natural and comfortable position.

[0022] The independent, multi-pivoting exercise arms of this invention transform traditional, single plane rotary movement exercises into multi-plane elliptical movements that bring a greater number of muscle groups into play and increase their involvement for a more effective workout. The user can selectively perform single plane rotary and user defined elliptical and multi-plane movements, making the apparatus much more versatile than prior art exercise arm assemblies. The ability of the handles to adjust and self-align, providing an unlimited number of possible hand positions, is important for the comfort of the user, particularly when the apparatus is used in the medical/rehabilitation industry where certain injuries can preclude the use of a fixed hand position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The present invention will be better understood from the following detailed description of some exemplary embodiments of the invention, taken in conjunction with the accompanying drawings in which like reference numerals refer to like parts and in which:

[0024] Figure 1 is a front view of an exercise arm assembly according to a first embodiment of the invention, with the arms shown in a rest or start position;

[0025] Figure 2 is a top plan view of the assembly of Figure 1;

[0026] Figure 3 is a side view of the structure of Figure 1;

[0027] Figure 4 is a front view similar to Figure 1, showing the arms fully extended;

[0028] Figure 5 is a top view of the assembly of Figure 4, showing the arms fully extended;

[0029] Figure 6 is a side view of the arm assembly in the fully extended position with the handles rotated to keep the user's hands in a comfortable position.

[0030] Figure 7 is a rear perspective view of a mid row exercise machine incorporating the exercise arm assembly of Figures 1 to 6;

[0031] Figure 8 is a front view of an exercise arm assembly according to another embodiment of the invention, with the arms in the starting or rest position;

[0032] Figure 9 is a top plan view of the assembly of Figure 8; and

[0033] Figure 10 is a side elevation view of the assembly of Figure 8.

DETAILED DESCRIPTION OF THE DRAWINGS

[0034] Figures 1 to 6 of the drawings illustrated an exercise arm apparatus 10 according to a first embodiment of the present invention. Figure 7 illustrates apparatus 10 mounted in an overhead position on the frame 12 of an exercise machine 14. In Figure 7, the arm assembly is arranged for performing mid-row exercises. However, it may alternatively be positioned on an exercise machine frame for performing other types of exercises, such as chest press, overhead press or pec fly exercises.

[0035] In prior application Serial No. 09/516,093 of Webber et al., filed February 29, 2000, the contents of which are incorporated herein by reference,

an exercise arm assembly is described which comprises a main arm pivoted to an exercise machine frame for pivoting about a first pivot axis, a swing arm pivoted to the end of the main arm for pivoting about a second pivot axis, and a handle pivoted to the end of the swing arm for pivoting about a third pivot axis. One such arm assembly is pivoted on each side of a user so that the user can grip the two handles in performing exercises. The two arm assemblies may be separately pivoted to the frame for independent movement, or pivoted about the same pivot axis for dependent movement. Each pivot axis is perpendicular to the other two pivot axes.

[0036] The exercise arm apparatus of Figures 1 to 6 comprises a pair of arm assemblies 15 each having a main arm 16, a swing arm 18, and a handle 20. The main arms 16 are secured together at their first ends, or may comprise one integrally formed, U-shaped arm member or yoke, with a pivot arm 22 extending from the central portion or connected ends of the main arms and having a pivot sleeve 24 defining a first pivot axis 25 for the main arms. Each swing arm 18 has a first end pivoted to the second end of the respective main arm 16 for pivoting about a second pivot axis 26. Each handle 20 is pivoted to the second end of the respective swing arm 18 for pivoting about a third pivot axis 28. Unlike the prior application referenced above, in this case the three pivot axes are not all perpendicular. In this case, the first and second pivot axes 25,26 are perpendicular, as indicated in Figure 6. However, the third pivot axis 28 is askew, extending at a non perpendicular angle to the swing arm center line, and is therefore also not perpendicular to either of the other two pivot axes. Pivot axis 25 is the main pivot which controls forward/rearward movement of the exercise arm assembly, while pivot axis 26 controls outward/inward movement of the swing arms, and pivot axis 28 controls rotational orientation of the handles. In this arrangement, no two pivot axes are parallel, and at least one pivot axis is non-perpendicular to the other two pivot axes. The non-parallel, non-

perpendicular handle pivot axis allows for different orientations of the user's hand during the exercise movement.

[0037] A pulley 30 is secured to the central portion of the main arms 16 via pulley mounting brackets 32, for linking the exercise arm apparatus to an exercise resistance, for example in the manner illustrated in Figure 7, as will be described below in more detail. Each main arm or main arm side portion 16 has a first bend 34 directing the arm generally downwardly and outwardly towards the junction with the swing arm 18. A pivot sleeve 35 is welded at the end of arm 16, and a U-shaped pivot bracket 36 at the corresponding end of the respective swing arm extends over opposite ends of sleeve 35, with a pivot pin 38 extending between the opposite ends of the pivot bracket and through sleeve 35 to allow pivoting of the swing arm about pivot axis 26. A range limiting device 39 identical to that described in U.S. Patent Application No. 09/516,093 referred to above is provided for limiting the range of outward and inward rotation of the swing arm between the start position illustrated in Figure 1 and the fully extended position of Figure 4.

[0038] Each swing arm has a bend 40 adjacent its second end for directing the end portion of the swing arm inwardly for attachment to the respective handle. A pivot sleeve 42 is welded to the end of each swing arm at a non-perpendicular orientation or skewed angle relative to the axis of the swing arm, as best illustrated in Figures 3 and 6. As indicated in Figure 6, the pivot axis 28 defined by pivot sleeve 42 is at an angle of around 108 degrees to the side centerline or axis of the exercise arm. Each handle 20 has a generally C-shaped yoke or bracket 43, with a hand grip 44 rotatably mounted between the opposing ends of the bracket, and a pivot pin 45 extending from a central portion of the bracket 43 away from the hand grip. The pivot pin 45 is rotatably mounted in sleeve 42.

[0039] The exercise arm apparatus 10 may be mounted on the frame of an exercise machine in any suitable manner, either suspended from an overhead strut, or secured to an upright strut, or to the base of the frame with the arms directed generally upwardly. Figure 7 illustrates one possible arrangement in which the apparatus 10 is mounted on a mid row machine 14. The frame 12 of the machine has a base 46 with a rear upright 48 on which a seat pad 50 is secured, and an upright weight stack guide frame 52 at the forward end of the base. A conventional weight stack 53 is slidably mounted on guide rods 54 in frame 52. Upright strut 55 extends upwardly from the base and has an upper, rearwardly directed portion 56 with a pivot mounting bracket 58 at its end on which the pivot sleeve 24 of the exercise arm apparatus is rotatably mounted. The exercise arm assembly 10 is therefore suspended from the end of overhead strut portion 56. Pulley 30 is linked to the weight stack 53 via a cable 60 extending from the weight stack around various pulleys mounted on the frame as well as pulley 30. Thus, front and back rotation of the arm assembly about the first or main pivot axis 25, in the direction of the arrow 62 in Figure 3, is resisted by the selected weight in weight stack 53. At the same time, the user can adjust their arm position and their hand position while performing the exercise, by rotating the swing arms in and out about axis 26, in the direction of the arrows 64 in Figure 1, and by rotating the handle about axis 28, in the direction of arrows 65 in Figure 1.

[0040] The machine of Figure 7 is designed to work the muscles of the upper back, also known as a mid row exercise. To perform the exercise, the user sits on the seat pad facing the machine and places their chest against chest pad 66. Stretching their arms forward, they grab the handles 20 and pull the exercise arm forward, towards their chest, rotating the apparatus about the first pivot axis 25. The second or swing arm pivot 26 allows the user to vary the spacing between their hands during the exercise motion. The user can choose between a narrow straight line pull, with the handles positioned at the spacing shown in

Figure 1, a wide straight line pull, with the handles spaced apart at their maximum spacing, as in Figure 4, or a diverging narrow to wide pull during the front to rear movement of the arm apparatus. The third, skew pivot axis of the handles allows the user to change the angular orientation of their wrist during the exercise motion, for more comfort, and to adjust to the changing handle separation or swing arm widths if the swing arms are swung out during the front to rear pulling motion.

[0041] Figures 8 to 10 illustrate a modified exercise arm apparatus 70 with three non-parallel pivot axes. In this case, no two pivot axes are perpendicular, and each pivot axis is askew to the other two. The exercise arm apparatus 70 comprises a pair of arm assemblies 75 each having a main arm 76, a swing arm 78, and a handle 80. The main arms 76 are secured together at their first ends, or may comprise one integrally formed, U-shaped arm member or yoke. In this case, the arms 76 are secured together by a first cross bar 82 spaced from their first ends, and by a pivot sleeve 84 extending across their first ends and defining a first or main pivot axis 85. Each swing arm 78 has a first end pivoted to the second end of the respective main arm 76 for pivoting about a second pivot axis 86. Each handle 80 is pivoted to the second end of the respective swing arm 78 for pivoting about a third pivot axis 88.

[0042] As noted above, in this embodiment no two pivot axes are perpendicular. As illustrated in Figure 8, the first or main pivot axis 85 is generally horizontal and in the plane of the page. The second pivot axis 86, in addition to being non-perpendicular to the pivot axis 85, is also skewed at an angle to the plane of the paper or the plane in which the main arms 76 lie, as indicated in Figures 8 and 10. The third or handle pivot axis 88 is also not perpendicular to the other two, and is askew such that it does not lie in the same plane as the main arm and main pivot axis or the swing arm and second pivot axis. As in the previous embodiment, pivot axis 85 is the main pivot which

controls forward/rearward movement of the exercise arm assembly, while pivot axis 86 controls outward/inward movement of the swing arms, and pivot axis 88 controls rotational orientation of the handles. In this arrangement, no two pivot axes are parallel or perpendicular to each other. The non-parallel, non-perpendicular handle pivot axis allows for different orientations of the user's hand during the exercise movement.

[0043] The exercise arm apparatus 80 may be mounted on an exercise machine frame in exactly the same way as the apparatus 10 as illustrated in Figure 7, or in other positions for performing different types of pushing or pulling exercises. Each main arm 76 has a first bend 90 directing the arm generally downwardly and outwardly towards the junction with the swing arm 78. A pivot sleeve 92 is welded at the end of arm 76, and a U-shaped pivot bracket 94 at the corresponding end of the respective swing arm extends over opposite ends of sleeve 92, with a pivot pin 95 extending between the opposite ends of the pivot bracket and through sleeve 92 to allow pivoting of the swing arm about pivot axis 86. As best illustrated in Figure 8 and 9, the pivot sleeve 92 is welded at a non-perpendicular, skewed orientation relative to the axis of the second or bent end portion of the respective main arm, such that it defines a pivot axis which is askew and non-perpendicular to the main pivot axis 85. A range limiting device 96 identical to that described in U.S. Patent Application No. 09/516,093 referred to above is provided for limiting the range of outward and inward rotation of the swing arm between the start position illustrated in Figure 1 and the fully extended position of Figure 4.

[0044] Each swing arm has a bend 98 adjacent its second end for directing the end portion of the swing arm inwardly for attachment to the respective handle. A pivot sleeve 102 is welded to the end of each swing arm at a non-perpendicular orientation or skewed angle relative to the axis of the swing arm, as best illustrated in Figure 8. As indicated in Figure 8, the pivot axis 88

defined by pivot sleeve 102 is at an angle of around 13.29 degrees to the axis of the swing arm. Each handle 80 has a generally C-shaped yoke or bracket 103, with a hand grip 104 rotatably mounted between the opposing ends of the bracket for rotation about a pivot axis 105 and a pivot pin 106 extending from a central portion of the bracket 103 away from the hand grip. The pivot pin 106 is rotatably mounted in sleeve 102. The hand grip 104 may also be rotatable about its central axis for added comfort of the user.

[0045] The exercise arm assembly of this invention overcomes a number of problems of previous pivoted exercise arms. The apparatus works equally well for both pushing and pulling exercises, and is designed to adjust automatically to the user's arm length and desired starting pre-stretch. It also has the ability to self-align during the course of an exercise movement for both the movement arc and the hand/wrist position, and the self-alignment takes place without affecting or being affected by the resistance load.

[0046] By dividing each exercise arm into three separate sections which are pivoted together by non-parallel pivots, with one or all pivot axes being non-perpendicular to the other two, the handles can be positioned at a comfortable gripping angle for the user at all times. Additionally, because the swing arm pivots below the level of the main arm pivot to the frame, and the angled bends are arranged to continue the swing arm outward and downward past the pivot connection, the swing arm hinge point can be brought in closer to the user, while still allowing the swing arm to swing out wide enough to perform the various exercises properly. The lowered hinge point, and outward angle of the swing arm, allows a greater increase in handle elevation at the outermost point of the swing. The swing arms are free swinging, and neither affect nor are affected by the resistance.

[0047] The pivoting handles have handgrips inboard of the swing arms and closer to the machine centerline, and thus the user, than the swing arms. The range limiting system on the swing arm hinge keeps the swing arm in a generally vertical orientation in the rest position. Overall, the arrangement allows the user to position their wrist at a position which is more comfortable and reduces the mechanical disadvantages for a smaller user with shorter arms. The pivoting handles with rotating grips inward of the swing arms allow for wrist and forearm pronation/supination (rotational movement). This provides multiple possible hand orientations, at any position between horizontal and vertical.

[0048] The exercise arms of this invention allow the user to perform either single plane rotary or multi-plane, user-defined elliptical movements which bring a greater number of muscle groups into play and provide a more effective workout. This transforms traditional, fixed arc, linear exercise movement patterns into user-defined, multiple converging/diverging exercise movement patterns.

[0049] Although some preferred embodiments of the invention have been described above by way of example only, it will be understood by those skilled in the field that modifications may be made to the disclosed embodiments without departing from the scope of the invention, which is defined by the appended claims.

WE CLAIM: